PRINT: ISSN 0972-3757 ONLINE: 2456-6360
Int J Hum Genet, 14(1): 43-48 (2014)
DOI: 10.31901/24566330.2014/14.01.07

Analysis of Physical Activity Intensity, Alexithymia, and the COMT Val 158 Met Gene Polymorphism

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KEYWORDS Alexithymia. Personality. Sport. Genetic Variants. Athlete

ABSTRACT The researchers investigated the relationship between intense training, the catechol-O-methyltransferase (COMT) Val108/158Met gene polymorphism, and alexithymia. Eighteen female and 77 male athletes were included. The Toronto Alexithymia Scale (TAS) questionnaire and polymerase chain reaction method were used to evaluate alexithymia and the COMT gene Val108/158Met polymorphism, respectively. Fifteen (15.8%) subjects were evaluated as alexithymic and 80 (84.2%) were non-alexithymic according to the TAS. The COMT Vall08/158 Met gene polymorphism frequencies were as follows: 17.9% Met/Met, 50.5% Val/Met, and 31.6% Val/Val. No difference were observed among training intensity, the COMT Vall08/158 Met gene polymorphism, and alexithymia($p > 0.05$). However, 60% of the alexithymic subjects trained intensively and only 6.7% trained lightly. Intensive and light training rates for non-alexithymic athletes were 46.3% and 20%, respectively. The Val/Val and Met/Met genotyping rates for athletes engaged in intensive training were 32.6% and 29.3%. In conclusion, no significant relationship was observed among TAS scores, the COMT gene polymorphism, and training intensity.

INTRODUCTION

Alexithymia is characterized by a difficulty describing and identifying emotions (Taylor et al. 2003). Although it was initially used to explain symptoms observed in people with psychosomatic disorders (Blanchard et al. 1981), today it often includes not only these patients but also people with other mental and physical disorders (Lumley et al. 1996; Topsever et al. 2006; Joyce et al. 2013) as well as healthy individuals (Borsci et al. 2009; Heinzel et al. 2012).

A relationship between sports and alexithymia has been proposed by researchers. However, only a few studies have been conducted on this issue. People with alexithymia can notice their feelings more easily in highly risky events that involve feelings such as anxiety. An alexithymic person may engage in hazardous activities to overcome anxiety such that there is a decrease in their anxiety at the end of the competition. These people deliberately prefer to participate in high risk fields and environments to regulate their feelings (Woodman et al. 2008; Allegra et al. 2007; Lafollie et al. 2007; Andres et al. 2014).

The findings observed in subjects with alexithymia have been argued to occur in frontal lobe functional disorders (Mc Donald et al. 1990; Sanchez-Navarro et al. 2005). A decrease in the expression of feelings is observed in people with frontal lobe damage (Struss et al. 1992). The ventromedial prefrontal cortex of the brain is concerned with affection. Findings of alexithymia such as decreased cognition and affection are related to this area (Lane et al. 1998; Schafer et al. 2007). There is also a connection between basal ganglia and prefrontal structures of the brain provided by dopamine (Alexander et al. 1990). Dopamine in the synaptic area is broken down by the catecholamine O-methyl transferase (COMT) enzyme. Low enzymatic activity occurs if a functional polymorphism (COMT Val108/158Met) is formed in the 158th codon of the gene that codes COMT (settled in 22q11.2 chromosome) if it contains a homozygous (Met) allele; however, enzymatic activity is high if it contains a homozygous (Val) allele. This functional polymorphism in the COMT gene causes 3–4 fold differences in enzyme activity. The Met allele leads to an increase in cognitive abilities and

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those related to the prefrontal area (Bilder et al. 2002; Egan et al. 2001). The decrease in dopamine levels in the prefrontal area is probably responsible for the cognitive and affective differences that are among the major characteristics of alexithymia (Ham et al. 2005). A relationship is observed between alexithymia and the COMT Val108/158Met polymorphism (Ham et al. 2005). A selective effect of the COMT polymorphism is seen in the prefrontal area. As a result, extracellular dopamine in the prefrontal cortex is broken down by COMT (Meyer-Lindenberg et al. 2005). The homozygote Met polymorphism in the COMT gene slows dopamine breakdown leading to an increase in prefrontal cortex function (Egan et al. 2001). Neurobiological theories that propose the pathogenesis of alexithymia have been presented in many studies. Among these are the breakdown of communication between the limbic and neurocortical systems, right hemisphere malfunctions, and disruption of the inter-hemispheral communication and dopaminergic pathway connections in the prefrontal area.

The purpose of this study was to investigate the relationship between alexithymia and the COMT Val108/158Met gene polymorphism in individuals involved with intensive sports activities.

METHODOLOGY

Ninety-five subjects who participated in sports volunteered for this study. The researchers obtained written informed consent from all participants. Their right to refuse to participate in the study or to leave at any point was stated, and they were assured that their data would be kept confidential.

Socio-demographic Information Form

In the information form that was designed to obtain information regarding the subjects' sociodemographic attributes, name-surname, age, gender, sport engaged in, and weekly training hours were asked. Training < 10 hours was considered low, 10–15 hours as moderate, and > 15 hours as intensive.

Toronto Alexithymia Scale (TAS)

The TAS is a self-report measure developed by Taylor et al. (1990) that consists of 26 questions. Answers are marked on 5-point Likert scale. Total scores obtained range between 26 and 130. Individuals with scores $\geq$ 74 were considered alexithymic; those with scores d" 62 were considered non-alexithymic. Validity and reliability tests were carried out in Turkish by Dereboy (1990). In this study, the internal consistency coefficient of the scale was 0.65 and the re-test reliability coefficient was 0.71. The scoring method of the TAS Turkish adaptation is different from that of the original version. A 5-point Likert scale system was employed in the original version, whereas a compulsory choice and answer system is used in the Turkish form. The cutoff score of the scale was 11. Those with a score $\geq$ 11 were considered alexithymic.

Molecular Analysis

Genomic DNA was extracted from 200 µl of EDTA-anticoagulated peripheral blood leucocytes using the QIAmp Blood Kit (QIAGEN, Valencia, CA, USA). The COMT gene polymorphism was detected by polymerase chain reaction (PCR) and Nla III digestion following the method of Yim et al. (2001).

The primers used were 52 -forward- TCGTGGACGCCGTGATTCAGG-32

52 -reverse- AGGTCTGACAACGGGTCAGGC-32

DNA was amplified for 35 cycles. Each cycle was comprised of denaturation at 95°C for 45 seconds, annealing at 55°C for 30 seconds, extension at 72°C for 90 seconds, and a final extension time of 10 minutes at 72°C. The initial denaturation stage was carried out at 95°C for 10 minutes. The PCR products were digested with the restriction enzyme Nla III at 37°C overnight. Nla III digests the PCR products from Val/Val homozygous individuals into 114-, 83-, and 20-bp fragments and from Met/Met homozygous individuals into 96- and 83-bp fragments. The digested PCR products were visualized on ethidium bromide-stained agarose gels that had been subjected to electrophoresis.

Statistical Analysis

Data were collected in the Microsoft Office XP Excel program and statistical assessments were evaluated using the SPSS 11.0 (SPSS 2001) statistical package. Number and percentage distributions, reliability (Cronbach's alpha) and

material analysis, and Pearson's correlation test were employed. The t-test, one-way analysis of variance and chi-square test were used to compare the different groups. Cross table interpretation was used to examine the reversal variation in the TAS groups (divided the three groups in themselves) Linear trend analysis was used to assess the COMT gene genotypes from low to high or from medium to high [Remark 2]. A $p < 0.05$ was considered significant.

RESULTS

The distribution of the subjects by gender was 18 (18%) females and 77 (77%) males.

The age distribution was: 27 (28.4%) $\leq$ 19 years, 50 (52.6%) 20–25 years, and 18 (18.9%) $\geq$ 26 years. Seventeen (17.9%) of the subjects trained at a low level, 32 (33.7%) at a medium level, and 46 (52.6%) at an intense level.

The distribution of the subjects for the COMT Vall08/158 Met gene polymorphism was 17 (17.9%) with Met/Met alleles, 48 (50.5%) with Val/Met alleles, and 30 (31.6%) with Val/Val alleles.

The subjects were distributed by TAS score as 80 (85%) non-alexithymic and 15 (15%) alexithymic.

No significant differences were observed between the TAS scores of subjects with different allele structures; however, the group with the Val/Val allele structure had a higher TAS score (Table 1). No significant relationship was found between weekly training hours and TAS score ($p > 0.05$) (Table 2). No relationship was observed between weekly training hours and the COMT Vall08/158 Met gene ($p > 0.05$) (Table 3). No significant relationship was found between weekly training hours and the COMT Vall08/158 Met gene or TAS scores ($p > 0.05$) (Table 4).

No significant difference was observed between TAS scores of the different age groups ($p > 0.05$). Subjects who were $\leq$ 19 years had higher TAS scores. No significant difference was observed between the age groups and the COMT Vall/08158 Met gene. Although no significant difference was observed between the groups by age and gender ($p > 0.05$), male subjects were more alexithymic compared to that of female subjects. No significant relationship between gender and the COMT Vall/08158 Met gene was observed ($p > 0.05$).

Table 1: Groups by TAS score and Comt Val 158 Met Gene

	(n)	*TAS score average*	*Standard deviation*	*P*
VAL/VAL	30	8.20	3.718	
VAL/MET	48	6.77	3.726	
MET/MET	17	7.53	4.389	
Total	95	7.36	3.859	0.279

TAS: Toronto alexithymia score, COMT: catecol O-methyltransferase

Table 2: Weekly training hours and TAS scores

Weekly training hours	*Non-alexithymic (n)*	*Alexithymic (n)*
Low	16	1
Moderate	27	5
Intensive	37	9
Total	80	15
	P<0.05	

COMT: catecol O-methyltransferase

Table 3: Weekly training hours and Comt Vall08/158 Met Gene

Weekly training hours	*VAL/VAL(n)*	*VAL/MET(n)*	*MET/MET(n)*
Low	4	12	1
Moderate	11	16	5
Intensive	15	20	11
Total	30	48	17
	P<0.05		

COMT: catecol O-methyltransferase

Table 4: Weekly training hours and Comt Vall08/158 Met Gene and TAS scores

Groups by TAS score	*Weekly training hours*	*VAL/VAL(n)*	*VAL/MET(n)*	*MET/MET(n)*
Non-alexithymic	Low	3	12	1
	Medium	8	14	5
	Intensive	13	16	8
Total		24	42	14
Alexithymic	Low	1	0	0
	Moderate	3	2	0
	Intensive	2	4	3
	Total	6	6	3

P<0.05

TAS: Toronto alexithymia score, COMT: catecol O-methyltransferase

DISCUSSION

The purpose of this study was to identify a relationship between alexithymia and COMT

Val108/158Met gene polymorphism in individuals who participated in intensive sports activities. Eighteen women and 77 men were included.

The ratio of female subjects participating in the study was 18.9%, which was quite low. However, according to official data, the ratio of female athletes is changing year by year and is currently 20–30%. In Turkey, active participation by female athletes in sports activities is less than that in developed countries, and there are regional differences as well. Thus, the ratio of female athletes participating in the current study was compatible with the country's data. The ages of the participating athletes were 13–46 years (average, 21.97 years). Considering that the athletes were engaged in sports actively, it appeared that the age average was appropriate.

The researchers determined that 15.8% of the subjects were alexithymic based on their TAS scores. A limited number of studies are available on alexithymia among athletes. The ratio of athletes considered to be alexithymic according to TAS scores in Woodman et al. (2009) was 13.7%, which agreed with this result. The prevalence of alexithymia in normal individuals was 5% in an article by Blanchard et al. (1981). Such a significant difference between the incidence of alexithymia in people leading a sedentary lifestyle and those engaged in sports highlights the relationship between alexithymia and intensive training. People with alexithymia have difficulty perceiving and expressing their feelings, which makes highly risky environments attractive to them. Female athletes engaged in highly risky sports activities are more alexithymic than women participating in sports that pose low risk. In a study by Cazenave et al. (2007) alexithymia was an important motivation factor to participate in risky sports activities. They hypothesized that sky diving would provide alexithymic women with the possibility of emotional regulation. It was determined that there are fluctuations in the feelings of anxiety in skydiving athletes. People with alexithymia use sport as a means of expressing their feelings through actions rather than speech and creating kinesthetic feelings that occur during physical activity.

The functional polymorphism genotype distribution rates occurring in the 158th codon of the gene that codes the COMT enzyme were 31.6% Val/Val, 50.5% Val/Met, and 17.9% Met/Met. The subjects participating in this study were both healthy individuals and athletes. On one side the researchers had the results of COMT gene polymorphism for athletes and on the other side we had those for normal healthy individuals. In a local study, genotype distributions of the COMT gene were 35% Val/Val, 46% Val/Met, and 19% Met/Met (Erdal MF et al. 2001). In studies on vitilligo and migraine carried out in Turkey from which the researchers can acquire information about COMT gene polymorphism incidence, the Val/Val, Val/Met, and Met/Met ratios are 34% and 47%, 19% and 33%, and 46% and 21%, respectively (Erdal MF et al. 2001; Erdal N et al. 2002). The ratios of the COMT gene polymorphism genotypes in the present study were compatible with the ratios in those two studies. The distribution of the frequency of the COMT gene may vary according to population (Gonzales-Castro 2013; Hatzimanolis 2013). This population was closer to Caucasians and European countries and further from those of the Far East (Wu et al. 2001). From a different perspective, the ratios of the COMT gene polymorphism genotypes determined in athletes do not differ from those found in healthy individuals.

No significant difference was observed between the classification of subjects as alexithymic/ non-alexithymic based on TAS score and gender and age. A majority of studies found no relationship between alexithymia and age (Franz 2007). The result that the age frequency of the subjects participating in the study was 13–46 years and that there were 50 subjects between 20–25 years agreed with this finding. While the relationship between gender and alexithymia is controversial, more studies have found no significant relationship (Moriguchi 2007; Parker 2003).

In this study the ratio of females is 11.1%, which is a little less than that of males (16.9%); however, no statistically significant difference has been found.

No difference was observed in the COMT gene polymorphism in terms of age or gender. As gene polymorphisms are generally independent of age, this result is in accordance with expectations. The findings that determined no significant differences between the COMT genotype and gender comply with data in the literature (Hintsanen et al. 2008).

No significant relationship was found between the COMT gene polymorphism and TAS scores in this study. The COMT gene occurs in 40% of alexithymic athletes who have less

dopaminergic activity in the frontal area of the brain due to the Val/Val alleles ratio, whereas it is 30% in non-alexithymic athletes. Although a difference was not found, the Val/Val allele ratio of the COMT gene was higher in alexithymic athletes. The finding that 15 athletes were alexithymic according to TAS score may have played a role in the lack of statistical significance. Only one study in the English literature has examined the relationship between the COMT gene polymorphism and alexithymia as determined by the TAS score. In that study, Ham et al. (2005) applied the TAS to a medical student group and studied the COMT gene polymorphism. They found a higher ratio of the Val/Val allele in the cases with higher TAS scores and considered the subject to be alexithymic.

Assuming that alexithymic individuals may compensate for their expression of feelings and kinesiological affectivity with intensive training, the researchers examined these two parameters. No significant relationship was found between training intensity by alexithymic and non-alexithymic athletes according to their TAS scores. However, 60% of the alexithymic athletes trained intensively and only 6.7% trained at a low level, whereas this ratio was 46.3% and 20% in non-alexithymic athletes. Non-alexithymic behavior is observed in intensely training athletes (Purper-Quakil 2002). No relationship between the COMT gene polymorphism and training intensity has been found. About 32.6% of intensely trained athletes had the Val/Val genotype, and 23.9% had the Met/Met genotype. No significant relationship was detected after assessing the COMT gene polymorphism by the TAS score in terms of training intensity. Although statistics did not support the relationship between training intensity, alexithymia, and the COMT gene polymorphism in this study, the data obtained correlated with the parameters and were parallel with literature findings. The limited sample size of this athletes considered alexithymic was low and probably affected the statistical results.

Organic, psychoanalytic, and cognitive theories have a part in alexithymia etiopathogenesis. The observation that dopaminergic activity in the prefrontal cortex is affected by the COMT gene functional polymorphism constitutes the genetic aspect of alexithymia. As the incidence of alexithymia is at an undeniable level in athletes, the issue should inevitably be researched. Supporting and evaluating sports activities using physiological, social and psychogenetic concepts would substantially contribute to individual and social development.

REFERENCES

Allegra B, Noel-Jorand MC, Souville M, Pellegrin L, Therme P 2007. Intensive physical activity and alexithymia: Results from swimmers discourse analysis. *Psyhological Reports,* 100: 1129-1139.

Alexander GE, Cruther MD, Delong MR 1990. Basal ganglia-thalamocortical circuits: Parallel substrates for motor, oculomotor, 'prefrontal' and 'limbic' functions. *Prog Brain Res,* 85: 119-146.

Andres F, Castanier C, Le Scanff C 2014. Attachment and alcohol use amongst athletes: The mediating role of conscientiousness and alexithymia. *Addict Behav,* 39: 487-490.

Blanchard EB, Arena JG, Pallmeyer TP 1981. Psychometric properties of a scale to measure alexithymia. *Psychother Psychosom,* 35: 64-71.

Bilder RM, Volavka J, Czobor P, Malhotra AK, Kennedy Jl et al. 2002. Neurocognitive correlates of the COMT Val(158) Met polymorphism in chronic schizophrenia. *Biol Psychiatry,* 52: 701-707.

Borsci G, Boccardi M, Rossi R, Rossi G, Perez J et al. 2009. Alexithymia in healthy women: A brain morphology study. *J Affective Disorders,* 114: 208-215.

Cazenave N, Le Scanff C, Woodman 2007. The personality and psychological profiles of women engaged in risk taking sports. *Anxiety, Stress, and Coping,* 20: 421-435.

Dereboy IF 1990. Aleksitimi: Bir gozden gecirme. *Türk Psikiyatri Dergisi,* 1: 157-166.

Egan MF, Goldberg TE, Kolachana BS, Callicott JM, Mazzanti LM et al. 2001. Effect of COMT Val108/158 Met genotype on frontal lobe function and risk for schizophrenia.*Proc Natl Acad Sci USA,* 98: 6917-6922.

Erdal MF, Herken E, Yilmaz M, Bayazit YA 2001. Significance of the catechol-methyl transferase gene polymorphism in migrane. *Brain Res Mol Brain Res,* 94: 193-196.

Erdal N, Erdal MF, Camdeviren H, Gokdogan T, Herker H 2002. Bir grup saglikli gonullude katekol-O metiltransferaz (COMT) gen polimorfizmi. *Klinik Psikofarmakoji,* 12: 174-178.

Franz M, Popp K, Schaefer R, Sitte W, Schneider C et al. 2007. Alexithymia in the German general population. *Soc Psychiatry Psychiatr Epidemiol,* 43: 54-62.

González-Castro TB, Tovilla-Zárate C, Juárez-Rojop I, Pool García S, Genis A et al. 2013. Distribution of the Val108/158Met polymorphism of the COMT gene in healthy Mexican population. *Gene,* 526: 454–458.

Ham BJ, Lee MS, Lee YM, Kim MK, Cho MJ et al. 2005. Association between the catechol O-methyltransferase Val108/158Met polymorphism and alexithymia. *Neuropsychobiology,* 52: 151-154.

Hatzimanolis A, Vitoratou S, Mandelli L, Vaiopoulos C, Nearchou FA et al. 2013. Potential role of membrane-bound COMT gene polymorphisms in female depression vulnerability. *J Affect Disord,* 22: 851–858.

Heinzel A, Minnerop M, Müller H, Franz M, Hautzel H 2012. Alexithymia in healthy young men: A voxel based morphometric study. *J Affective Disorders,* 136: 1252-1256.

Hintsanen M, Elovainio M, Puttonen S, Kivimaki M, Lehtimaki T 2008. Val/Met polymorphism of the COMT gene moderates the association between job strain and early atherosclerosis in young men. *JOEM,* 50: 649-657.

Joyce AS, Fujiwara E, Cristall M, Ruddy C, Ogrodniczuk JS 2013. Clinical correlates of alexythymia among patients with personality disorder. *Psychotherapy Research,* 23: 690-704.

Lafollie D, Scanff LC 2007. Detection of high-risk personalities in risk sport. *L'Encephale,* 33: 135-141.

Lane RD, Reiman EM, Axelrod B,Yun LS, Holmes A, Schwartz GE 1998. Neural correlates of levels of emotional awareness: Evidence of an interaction between emotion and attention in the antrerior cingulate cortex. *J Cong Neurosci,* 10: 525-535.

Lumley MA, Stettner L, Wehmer F 1996. How are alexithymia and physical illness linked? A review and critique of pathways. *J Psychosom Res,* 41: 505-518.

Mcdonald PW, Prkachin KM 1990. The expression and perception of facial emotion in alexithymia: A pilot study. *Psychosom Med,* 52: 199-210.

Meyer-Lindenberg A, Kohn PD, Kolachana B, Kippenhan S, McInerney-Leo et al. 2005. *Nature Neuroscience,* doi.10.1038/nn1438, 1-3.

Moriguchi Y, Maeda M, Igarashi T, Ishikawa T, Shoji M et al. 2007. Age and gender effect on alexithymia in large, Japanese community and clinical samples: A cross-validation study of the Toronto Alexithymia Scale (TAS-20). *Biopsychosoc Med,* 1: 7.

Parker JD, Taylor GJ, Bagby RM 2003. The 20-item Toronto Alexithymia Scale IV: Reliability and factorial validity in a community population. *J Psychosom Res,* 55: 269-275.

Purper-Quakil D, Baup G, Mouren-Simeon MC 2002. Psychopathology in children and adolescents with intensive physical activity: Case study and overview. *Annales Medico-Psyhologiques,* 160: 543-549.

Sanchez-Navarro JP, Martinez-Silva JM, Roman F 2005. Emotional response in patients with frontal brain damage: Effects of affective valence and information content. *Behav Neurosci,* 119: 87-97.

Schäfer R, Popp K, Jörgens S, Lindenberg R, Franz M, Seitz RJ 2007. Alexithymia-like disorder in right anterior cingulate infarction. *Neurocase,* 13: 201-208.

Struss DT, Gow CA, Herherington CR 1992. "No longer Gage": Frontal lobe dysfunction and emotional changes. *J Consult Clin Psychol,* 60: 349-35.

Taylor GJ, Bagby RM, Parker JDA 2003. The item-20 Toronto Alexithymia Scale IV: Reliability and factorial validity in different languages and cultures. *J Psychosom Res,* 55: 277-283.

Taylor GJ, Bagby RM, Ryan PD, Parker JD 1990. Validation of the alexithymia construct: A measurement-based approach. *Can J Psychiatry,* 35: 290-297.

Topsever P, Filiz T, Salman S, Sengul A, Sarac E, Topalli R, Gorpelioglu S, Yilmaz T 2006. Alexithymia in diabetes mellitus. *Scott Med J,* 51: 15–20.

Yim DS, Park SK, Yoo KY, Yoon KS, Chung HH et al. 2001. Relation between the Val158Met polymorphism of catechol O-Methyl transferase and breast cancer. *Pharmacogenetics,* 11: 279-286.

Woodman T, Cazenave N, Le Scanff C 2008. Skydiving as emotoin regulation: The rise and fall of anxiety is moderated by alexythymia. *Journal Sport Exerc Psychol,* 30: 424-433.

Woodman T, Huggins M, Le Scanff C, Cazenave N 2009. Alexythymia determines the anxiety experienced in skydiving. *Journal Affect Disorders,* 116: 134-138.

Wu RM, Cheng CW, Chen KH, Lu SL, Shan DE et al. 2001. The COMT L allele modifies the association between MAO-B polymorphism and PD in Taiwanese. *Neurology,* 56: 375-382.